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NOTES ON
SOME INJURIOUS INSECTS,

By JOHN G. JACK,

Arnold Arboretum, Jamaica Plain.

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Notes on Some Injurious Insects.

By JOHN G. JACK, Arnold Arboretum, Jamaica Plain.

The subject of injurious insects is so broad and many sided, that it is not easy to select particular points for a short review, without seeming to neglect others equally important; because every person naturally regards those insects which attack his particular plants or crops as deserving of the most attention.

The ravages of some species of insects appeal to, and directly or indirectly affect, almost everybody over a wide area; as in the cases of the Potato Beetle (*Doryphora decem-lineata*), and the Tent Caterpillar (*Clisiocampa Americana* and *C. sylvatica*). The different species of insects which derive their sustenance from plants may be numbered by tens of thousands in North America and Europe; but very few of them are likely to attract the attention of people who are not entomologists. In the United States, for instance, there are recorded more than five hundred kinds of insects which feed upon the oaks, and there are undoubtedly hundreds of others which have not been studied.

While we have many kinds of insects which may be called standard pests, or which are pretty constantly abundant and injurious to certain plants, we can never be sure from what quarter a new depredator may appear, or what hitherto healthy plant may be afflicted with an enemy not recognized as previously affecting, or seriously injuring it.

It sometimes happens that an insect, once considered rare, suddenly becomes conspicuously abundant and destructive for a season, or longer, and then it may almost entirely disappear from notice for an indefinite time. An insect hitherto regarded as common, may become a great rarity, or even extinct.

The commonly injurious insects may, in the course of nature, be much lessened for a time, by various agencies. The *Clisiocampa Americana* or Tent Caterpillars of early summer, for instance, hatch from the eggs very early in the spring, and the young larvæ may be largely destroyed by late frosts, or a period of cold, wet weather. An almost complete cessation of injuries by a species of borer, which was destroying immense numbers of conifers in the forests of West Virginia a year or two ago, is only accounted for by the severity of the preceding winter which, it is supposed, killed the insects.

Certain kinds of birds are fond of particular species of insects, and if a large flock of these should pass through an infested region at the proper time, a great diminution of that special insect pest would be the natural result.

Predatory insects and natural parasites are great aids in preventing the too great increase of injurious species, sometimes waging a war almost of extermination against them. Occasionally bacterial or fungal diseases may cause widespread destruction among insect tribes, as well as among higher animals.

Sometimes we find one species of insect supplanting another which had much the same habit and fed on similar plants. The common White, or Cabbage, Butterfly (*Pieris rapæ*), was first landed from Europe, at Quebec, and as it has spread southward and westward, the native white butterflies have become quite rare in many regions. The imported Cabbage Butterfly itself is not so abundant and destructive as it was at first, because its numbers have been greatly reduced by a minute parasitic fly which has followed it.

In recent years the ravages of insects have become more and and more noticeable, and have necessarily received greater attention from cultivators. The destruction of the native wild plants upon which indigenous insects originally fed; the increased areas under cultivation, and the consequent abundance of food supply of certain kinds; the improvement and diversity of cultivated plants — are all factors which have constantly tended to attract insects from their native waste places and woods, to our gardens, field crops, and orchards. Very often, as our population has increased, certain kinds of valuable insect eating birds and other animals have become scarcer.

With active immigration and importation, we must expect also to receive and naturalize more species of those insects which are natives of, and are troublesome in, other countries.

Among the most conspicuous of such immigrants already settled among us, and now well known in the different branches of horticulture and agriculture, we have the Codling Moth (*Carpocapsa pomonella*), the Oyster-shell Bark-louse (*Mytilaspis pomorum*), affecting the apple and other allied fruits; the Fluted Scale (*Icerya Purchasi*), destructive to trees of the Citrus group, and others, in

California; the imported Currant-borer (*Ægeria tipuliformis*), and the Currant-worm (*Nematus ventricosus*), affecting both red currants and gooseberries; the Asparagus Beetle (*Crioceris asparagi*); the Gypsy Moth (*Ocneria dispar*), and the Leopard Moth (*Zeuzera pyrina*), which has got a foothold in New Jersey, and is destructive to elms by boring into the branches.

Our orchid growers received the Cattleya Fly (*Isosoma orchidearum*) through importation, and within a few years cattle raisers have become familiar with the Horn Fly (*Hœmatobia serrata*), which is spreading over the country.

In these notes I intend to refer chiefly to a number of insects, mostly very common, about which I am most often questioned by residents of this vicinity.

Those insects which, instead of feeding externally, pass the most mischievous time of their lives in boring within the tissues of plants, offer one of the most difficult classes to deal with and keep in subjection, if once allowed to become abundant. In order to combat them with best results the life history of each species should be known. After they have entered and begun boring in the wood or stem of the plant, it is rarely possible to get at them with insecticides. Probing for the larvæ in the stems, or cutting out the affected parts, remain as cures. But, if possible, we should anticipate the disease by destroying the adult insects, before their eggs are laid, or otherwise prevent their deposition of eggs. Besides the direct injury to the plant by borers, the holes made by them are openings for the entrance of destructive fungi and disease-laden moisture.

One of the most notable and troublesome of these tree destroying pests, is the Locust Borer (*Cyllene Robiniœ*), which makes it a difficult matter to grow the valuable and beautiful locusts or Robinias in some localities. The trunks and larger branches of trees are sometimes so thoroughly honeycombed by these borers that they are liable to break off in any strong wind. If we carefully examine the bark in the latter part of August and during September, we are likely to find these handsome, brown and yellow banded, wasp-like beetles laying oval, dull white eggs, in crevices in the bark, and especially about old wounds.

These eggs hatch in a week or two and the young larvæ eat their way into the bark and towards the interior. They are yet quite small when winter overtakes them, during which season they remain dormant. With the return of warm weather they renew their boring operations, and increase rapidly in size until about the beginning of August, when they cease feeding and enter the pupal stage. A week or two after this they emerge as beetles from their burrows in the wood. Thus they complete the cycle of their existence in just a year.

The beetles are particularly fond of golden rod and some other yellow flowers, and they should be killed whenever found. They are easily captured, and should be collected from the bark of the trees they infest. The aim should be to prevent egg-laying. This may best be accomplished by giving the trunks and larger branches a thorough and heavy washing of soap. There are many ways by which fairly efficient washes may be made, and different ingredients may be added; but the following formula, proposed by Dr. Charles V. Riley, may be taken as a good standard, for a soap to be applied to the trunks of trees to prevent the inroads of borers.

Potash lye, one pound; fish oil, three pints; soft water, two gallons. Dissolve the lye in the water, and when brought to the boiling point, add the oil, and boil the whole about two hours. Water is added to make up the evaporation by boiling, and the result will be, twenty-five pounds of soft soap, which will make from fifty to one hundred gallons of trunk wash, according to the amount of dilution. The application of the wash should be most thorough, so that it shall enter well into the crevices of the bark. In this region it should be applied about the 20th of August, and again in two or three weeks, if much washed by rains. It is particularly important that the trees should be looked after when young.

The young branches of the locusts are subject to serious injury from another borer, the larva of a small moth (*Ecdytolopha insiticiana*). This insect causes a swelling of the part of the twig affected, and an examination in summer will show that it is hollow and inhabited by a small white larva, which becomes fully grown and leaves the twig at the end of summer, and usually forms its chrysalis on the ground. The best remedy which can be suggested is to cut off these branches below the parts affected, and destroy them with their contained larvæ. This work must be done in summer when the swollen parts are green and fresh and the larvæ are in them; otherwise it will be labor wasted. The trees are rapid growers and will soon recover from a necessarily vigorous pruning. If care is taken to taken to cut and burn all the infested twigs in any locality, there will very likely follow a period of comparative freedom from injury.

Complaints are often made of destruction of the ornamental mountain ash, hawthorns, and apple trees, by the Round-headed Apple Tree Borer (*Saperda candida*). This insect most commonly attacks the lower part of the trunks, at or near the ground. The egg-laying takes place in June and July, and it is at that time that the trunks should be covered with the soft soap wash, if there is any danger of attack.

It is said that this insect does not complete its growth, and reach the perfect, or beetle, stage until the third year from the time the egg is laid. Throughout this period it remains in the wood, actively boring during the growing seasons. The greatest danger to the life of the tree is caused while the insect is boring in the sapwood, and before it goes deeper into the trunk; because the tree may thus become practically girdled and killed, as the sapwood is the most vital part, being the medium through which the sap is conducted from the roots to the branches and foliage.

The presence of the borers may often be detected by the fine sawdust-like material thrown out from cracks in the bark, and the well-known practice of reaching after and destroying them with a flexible wire may be tried. In thin-barked trees, when the borers are at work directly under the bark, they usually cause a drying and discoloration of it, and the larvæ may thus be located and cut out. The pale brown and white striped beetles of this species are not often seen, because they usually move about in the dusk, and remain quiet during the day.

The opposite of this habit is seen in the beetle of the Flat-headed Apple Tree Borer (*Chrysobothris femorata*), which delights to bask in the sunshine on the bark of the trees; but the color of the insect harmonizes so well with the general color of the bark, that it is not easily detected. This species is often more common than the other, and does more widespread injury. As the name indicates, the boring larva has a broad flattened head, and a comparatively slender body.

It rarely attacks well established, vigorous, perfectly healthy trees, but prefers those of feeble growth, or which are already injured. It is very liable to attack young, newly transplanted trees, which may be girdled in a single season. Ingress is often afforded where branches have been cut off and the wounds are not thoroughly covered. It reaches full development within a year from the time the egg is laid.

The use of soap wash, to prevent the successful laying of the eggs, is the best protection. It should be applied with particular care, about all wounds or scars, and in the forks of the large branches. Young, newly planted trees should be especially attended to, in all localities where there is any trouble from this pest. The application of the wash at the same season will serve against both the Round-headed and the Flat-headed borers, but in treating for the former, the soap should be applied very close to the ground, or even a little below the surface, scraping away a little of the loose soil for that purpose and replacing it afterward.

The same preventives and remedies can be applied for a large proportion of the kinds of borers which injure the stems and branches of our trees and shrubs. The damage is done by the insects while in the state of grubs or larvæ, which are hatched from eggs that are usually deposited upon or within the bark; and the best mode of controlling them is to prevent their entrance. In applying washes to the bark, we should know the habits of the parent insects, and especially at what season their eggs are deposited, because any washes applied at the wrong time will do little or no good.

Sometimes the stems of plants may be so fully infested that it would be better to cut and burn them while all the insects are within. In the Arnold Arboretum the stems of the native willows, of many species, have recently become greatly infested by an imported beetle (*Cryptorhynchus lapathi*) belonging to the curculio family. This insect may give great trouble to willow growers, and as willows grow easily and rapidly from cuttings or from the stumps, it may be that our best remedy will be found in cutting down and burning all infested parts of the plants while the pests are within them.

Borers in small branches and twigs are sometimes troublesome. The Oak Pruner (*Elaphidion villosum*), for instance, often causes small branches of oak, apple, and other trees to break off and fall to the ground in the autumn and winter. As the larvæ remain in the twigs all winter, they are easily destroyed by collecting and burning the detached branches.

Many insects, which cause the curious abnormal growths known as galls, remain in these habitations during the winter, and, if troublesome, they may be cut off at this season and burned. The large moss-like growths on sweet-brier and some other roses, are familiar examples.

While the largest number of species of injurious borers belong to the beetle family, we have also a good many moths whose larvæ are borers and thus do much damage to the trunks and branches of trees.

The ravages of the Peach Tree Borer (*Ægeria exitiosa*) are only too well known in many localities. The perfect insect is a moth, which flies in the daytime, and has a wasp-like aspect. In midsummer, the female deposits her eggs on the bark, generally near the surface of the ground. As soon as hatched the young larvæ proceed to bore inwards and downwards, and usually their presence may be detected by free exudations of gum.

A heavy wash of soap is a good preventive of egg deposit, but it should be applied two or three inches below the surface as well as above ground.

Where the borers already exist, an effective remedy has been found in removing some of the soil from the base of the tree, forming a little hollow and filling it with boiling hot water. The larvæ will be killed and the tree not hurt.

This suggests the practicability, in exceptional cases, of killing other borers, higher in the trunks of smooth barked trees, by winding a piece of waterproof cloth around the affected part of the trunk, the upper end open and somewhat flaring, and the lower tightly bound about the bark. Filling this with very hot water for a moment or two, would destroy borers otherwise hardly accessible. A drop of kerosene will always kill borers, if it can be forced into the holes so as to come in contact with the insects.

The upper portions of the roots, near the bases of the stems of blackberry and of our common clematis or virgin's bower, have, in this region often been found infested by the boring larvæ of two species of day-flying moths (*Bembecia marginata* and *Acalthœ caudata*). Very good remedies may be found in scraping away some of the soil, and giving the infested parts a good dose of boiling water, or a heavy watering of kerosene emulsion.

Larvæ of such insects as the Codling Moth (*Carpocapsa pomonella*) and Plum Curculio (*Conotrachelus nenuphar*), are, in a certain sense, borers, and the application of insecticides can be only partially successful.

Recent experiments have shown that some value may be attached to arsenical remedies if applied at the proper times. The eggs of the Codling Moth are laid on the surface of the fruit, usually about the calyx lobes, and the young larva may take enough of the poison to kill it before it succeeds in eating into the apple, where it would be safe. On the other hand the Plum Curculio deposits its eggs within punctures or holes which it makes in the flesh of the fruit, so that its grubs are generally out of the reach of poisons. But as the beetles bite into the fruit for the purpose of oviposition, and also feed upon the young fruit and foliage, they may themselves take enough of the insecticide to prove fatal.

The Plum Curculio is not merely an enemy to the culture of plums, cherries, and other stone fruits; if neglected it may become very destructive to such fruits as apples and quinces. During the past summer I saw an orchard in which hundreds of bushels of apples, chiefly of the Oldenburg variety, were ruined by this insect, either by the beetles depositing their eggs in the young fruit, or by the grubs living within it, or by the beetles biting holes on the surface of the apples as they neared maturity, and thus destroying their commercial value. As this orchard is in the vicinity of many long-neglected plum trees, where curculios have prevented the perfecting of any fruit, it may be that they have been forced to seek other food than their first choice, and in this case we have another example of the evil of neglect.

In combating both Codling Moth and Plum Curculio, it is an excellent practice at once to collect and destroy all diseased fruit as soon as it falls; also all infested fruit seen while the larvæ are within it.

A peculiar class of borers consists of those usually very small species which mine or tunnel within the parenchyma, or between the upper and lower surfaces of the leaves. These little insects are not often very troublesome in this region, but occasionally they cause much annoyance. Their depredations usually appear in the form of blotches, or irregular, gradually enlarging lines through the leaves.

The locust leaves are very commonly much injured by large, whitish blotches which are the mines of a beetle (*Hispa suturalis*). Many persons in the vicinity of Boston have noticed the ugly, dark blotches, which have sometimes appeared in the handsome foliage of the tulip trees, caused by larvæ of a small, mosquito-like fly (*Cecidomyia liriodendri*). At the Arnold Arboretum and other places, alders have been annually stripped of most of their leaves by the larvæ of a small sawfly (*Fenusa varipes*), which have been so numerous as to completely clean out the interior of the leaves, leaving only the dry skeletons and skins, which wither and fall in midsummer.

Pale colored lines, sometimes zigzag and irregular — sometimes following the margins or veins of the leaves, are often found on cinerarias, eupatoriums, Paris daisies or marguerites, and similar plants in the garden and greenhouse. These are caused by the larvæ of very small, dark gray flies, which live within the leaves. Infested leaves should be removed and destroyed whenever seen, or if the leaves are few and not badly injured, and it is desirable to retain them, they may be held up to the light, when the little larvæ can be easily seen at the ends of their tunnels, and crushed.

These pests have sometimes done much damage to the foliage of cinerarias, eupatoriums, and other composite plants in greenhouses in this region. They are liable to affect chrysanthemum leaves. Leaf-mining insects, being secure from insecticides, are not easily dealt with. Hand-picking and burning of the infested leaves is the usual remedy advised.

The foliage eaters among insects probably attract the most general attention. In this part of the country there are three or four species better known than all others. These are within fairly easy control and it is due to our own carelessness if we allow them to increase to a very injurious degree. It would seem as though their habits must be too well known to require mention, but numerous questionings show how little they are understood.

The Tent Caterpillar (*Clisiocampa Americana*), so common in spring and early summer, may be easily located by the tent-like web in which the caterpillars live when not out feeding. They may be found in their webs in the early and late parts of the day, and on cool cloudy days, and are then most easily destroyed. During the warm part of the day they may be scattered on the foliage; then collecting them is more difficult and uncertain.

In midsummer the moths deposit their rings of eggs on the small twigs, upon which they remain until they hatch in the following spring. These rings of eggs are fairly large, and sufficiently conspicuous to be readily seen and removed in winter; thus much labor may be saved for the busy months of spring and early summer. In Newton and some other neighboring towns this practice has been encouraged; children have been taught to become quite interested in the work, and, so employed, spend many hours out of doors in healthy, useful exercise. As a boy, in my father's orchard, I have frequently, as the result of my efforts during a school holiday, collected four hundred or five hundred rings, each of which, if left to hatch, would mean a web with several hundred caterpillars. As a reward for my industry, I was paid a cent a dozen for the rings.

Apple pickers should be told to remove the rings whenever seen. As the insects are partial to the Black and Choke Cherries, these should also be examined and all the eggs that are found should be destroyed.

I understand that a committee has been appointed by this Society to see to the "extermination of the Tent Caterpillars." As these insects extend from Canada to Texas and from Maine to California it will be seen that the committee has a long and hard task before it.

In July and August there appear other tent-building caterpillars which are very different from the earlier kind, both in appearance and habits. These are known as the Fall Web-worms (*Hyphantria cunea*). The moths of this species are of a milk-white color, with or without a few black dots on the wings. They deposit their eggs in broad patches, on the under sides of the leaves, about the end of May or in June. The caterpillars become fully grown at the end of summer, or in early autumn; then go to the ground to pupate and reappear as moths in the next spring and early summer. Farther south, there are two broods of this insect in the year. From their habits it will be seen at once, that egg collecting is not practicable, and that the insect can best be controlled by the removal of the webs and caterpillars whenever seen. Until they are almost fully grown the caterpillars will always be found within or about their webs. The moths also should be killed whenever found. This species seems most partial to Poplars, Willows, Elms, and some Maples; but they commonly affect a great variety of shade trees, fruit trees, and shrubs.

The Canker-worms (*Anisopteryx vernata* and *A. pometaria*), which, besides other plants, particularly affect our elm and apple trees, have probably received as much attention in Boston and vicinity as in any part of the country. Yet the value of the well-known tar-coated or ink-coated bands, placed on the trunks of the trees, is but little understood, and complaints are often made of their inefficiency. This worm is one of the easiest to control of all our insect pests; the chief requisites being the proper banding of the trunks at the right season, and care to keep the tar or ink coating in good effective condition.

The female canker-worm moths are wingless. The larvæ (known also as loopers, inch-worms, or measuring-worms, from their manner of locomotion) drop or crawl to the ground to pupate, and when the moths emerge they must creep up the trunk of the tree in order to deposit their eggs on the branches, where they are usually placed. A proper band will keep every female moth from ascending. Bands of printer's ink, six inches or more in width, applied directly on the bark, or upon stout cloth or other material, are most commonly employed, and are quite as efficient as the much more expensive oil troughs occasionally used. The object is to prevent the wingless females from ascending, by entrapping them in the sticky substance. The moths ascend both in the late autumn and in spring; therefore, in order to keep all from passing over the bands, these must be kept in a moist and sticky condition from the last of October until hard frosts in December, and again in early spring until no moths are to be found climbing the trees. An unusually mild period in winter may induce some of the moths to come out, and in such an event the bands should be freshly coated. It is also well to keep the bands sticky until after apple blossoming time, so that any young larvæ, which may have hatched from eggs deposited below the bands, will not be able to ascend.

Besides printer's ink, any sticky substance may be used which does not dry too quickly. Among such substances may be mentioned tar, mixed with oil to prevent too quick drying; slow drying varnishes; the German preparation known as Insect Lime, and even thick refuse molasses. When the substance is applied on a band of cloth or other material it is very important that no large, open crevices remain on the bark beneath; tow, or cotton batting, will be found a good filling. No contiguous trees should remain unprotected.

The Tussock Moth (*Orgyia leucostigma*), so familiar to everyone in the habit of crossing Boston Common in summer, is another insect easily within control of those who are willing to take a little care of their trees. The female moth of this species is wingless, like that of the canker worm, but its caterpillar, instead of going to the ground to form its chrysalis, goes through all of its transformations on the tree. The caterpillar usually makes its dull gray cocoon on the bark of the trunks or branches. When the female moths emerge from the chrysalids they deposit their eggs in a mass upon the cocoons from which they came. These cocoons and the whitish egg-masses are readily seen, and if they were collected in winter and destroyed, we should have no further trouble with this pest.

There are ten or a dozen known species of parasites which prey upon this insect. As the cocoons which produce the male moths bear no eggs they need not be gathered; in fact all non-egg-bearing cocoons might be left as likely to harbor parasites of the Tussock Moth, and these parasites are valuable allies in keeping the numbers of caterpillars in check. If unskilled labor is employed, or the presence of the cocoons is objectionable, it may be found best and most economical to remove all, regardless of the parasites, which would have no work left if the trees were thoroughly cleared; moreover, parasites are common among other kinds of insects, so that there is no danger of their extermination.

Nearly every season, we, in Boston, hear complaints of the damage by caterpillars to the Japanese Ampelopsis or "ivy," now so much used in covering buildings. These caterpillars are usually of a pale bluish color, with slender black lines, and an orange colored band across each segment. The larvæ are often so abundant as to strip the plants of most or all of their leaves. They also feed upon American Ampelopsis or woodbine, and the species of grape. They are the caterpillars of handsome, velvety, blue-black, day-flying moths (*Alypia octomaculata*), which expand about an inch and a quarter across the wings; have two, large, pale yellow spots on each front wing, and two white spots on each hind wing. Besides flying about the food plant of their young, these moths may be seen on the flowers of the mountain ashes, *Deutzia gracilis*, and other blossoms, in our gardens in early summer. It would be well to catch and destroy them whenever seen. On limited areas the caterpillars may be picked by hand, but where insecticides must be used, spraying with a mixture composed of about a teaspoonful of Paris Green in two gallons of water, is effectual. Hellebore also, either as a powder, or in water, is said to be efficient, and it has the advantage of not being so dangerous to persons or foliage.

The larch or tamarack is a favorite among many tree growers in this part of the country, and it has been much planted for shade, ornament, and utility. Within the past few years we have often heard complaints of the destruction of the foliage by little greenish white larvæ. The trees are commonly stripped of their leaves by midsummer, and their beauty is quite destroyed. They are rarely killed however, as they have the power of readily sending out a new supply of leaves; but their growth is much retarded and their aspect somewhat changed by frequent attacks.

These insects are the larvæ of little sawflies (*Nematus Erichsonii*), which deposit their eggs in rows in the tender young twigs and cause those parts of the twigs bearing eggs to bend to the side in which they are laid. They do not appear to have attracted attention here until about 1880, although they were probably present long before. They attack both European and American larches, usually appearing in large numbers and accomplishing their work rapidly. It is a difficult matter to control this pest on large trees, but, if applicable, almost any of the insecticides will prove effective. The insect belongs to the same group as the Currant-worm, so easily controlled by hellebore. The cocoons, with pupæ, are to be found under the trees in autumn and spring, and if all debris was raked up and burned, or the ground trampled by cattle, great numbers of them would be destroyed.

Aphides and plant-bugs form a class of plant pests which are difficult to keep in subjection. This is partly because of the very rapid development and prolific reproduction, of certain species, and because of their peculiar adaptation for taking nutrition from the plants, without eating any of the plant tissues. These insects are without regular jaws or mouth parts, but in place of these are provided with beaks for sucking liquid food, from either plants or animals, after the manner of the mosquito. It is on this account that the ordinary insect poisons are often useless when applied against them, for the ends of their beaks being within the plant tissue, they take none of the poison with their food.

A most efficient remedy remaining is found in suffocation, which may be accomplished by the use of oils, tobacco smoke, or irritants like pyrethrum powder. Like other insects these breathe through numerous small openings or spiracles, generally situated along the sides of their bodies, and it is by closing or irritating their breathing organs, and thus practically causing suffocation, that kerosene emulsion, whale oil soap, and other allied insecticides prove effective. It must be remembered, however, that these remedies are often of little use against the more active, stronger insects, and are most effectual when applied against those which are weak, sluggish, or soft.

The young terminal shoots of many shrubs and young trees are often stunted and made to grow in unnatural, bushy forms, by little greenish bugs or hoppers of various species, which puncture and suck the sap from the leaves and tender stems and cause these distortions. The annual growth of young maples, lindens, locusts and other trees are often thus checked from several inches to a foot or two, and the lateral buds are crowded in large numbers near together around the twigs, resulting in injury to the appearance, value, and development of the tree.

Little green and red banded hoppers, commonly but erroneously called "Thrips", suck the sap from grape leaves, causing them to become spotted and dry; a small green species is sometimes so plentiful on rose bushes as to cause the leaves to dry and fall on account of the constant piercing and loss of sap.

The disease of chrysanthemums which causes the young growths to become bunched and impairs the flowering value of the plant — causing it to become "blind" as some cultivators express it — is probably mostly due to injuries of the same nature.

In their winged state, many of the little bugs which cause this mischief take alarm and fly away so quickly that they are scarcely seen; if the young are on the plants they conceal themselves if possible.

Frequent and thorough spraying with a strong decoction of tobacco and soap, or the use of kerosene emulsion, and the dipping of infested branches into the emulsion, will be found valuable in lessening the injuries on small trees, shrubs, and other plants. Covering small plants and fumigating with tobacco is effective. Good results will also be obtained by dusting with fresh pyrethrum powder, or tobacco dust; these remedies are clean and easily applied. But, as many of these insects feed upon grass and other herbage, fresh supplies of the pests may be constantly on hand, unless such plants as the chrysanthemums are well isolated.

A large net made of fine mesh mosquito netting, drawn quickly around and among the plants, will capture great numbers of the winged insects. If chrysanthemums were protected by gauze covered frames, there should be no trouble from the pests.

Scale Insects and Mealy Bugs obtain their food by sucking the sap of plants through beaks, in the same manner as the Aphides and the true bugs. The different species vary so much in habit that no rule is applicable to many of them together. From delicate plants, and when the scales are mature, it is often necessary to remove the pest by hand. On strong plants, especially woody species, the stems and branches may be washed with whale oil soap or kerosene emulsion with good effect. In this work a knowledge of the habits of the species to be combatted will prove of the greatest advantage. For instance, we find that the Oyster-shell Bark-louse (*Mytilaspis pomorum*), of the apple and other fruit trees, hatches from the egg and begins life as a little, active, light-colored louse, in the latter part of May or in June, and this is by far the best time to attack it. At this time sprayings of ordinary kerosene emulsion would destroy every louse with which it came in contact. Later, the insects become fixed on the bark, from which they never afterwards move, and as the season advances they become protected by the well-known scaly covering, which offers a considerable resistance to insecticides.

Nuthatches, chickadees, woodpeckers of several species, and some other birds, do a vast amount of little appreciated benefit by clearing off the scale insects which infest the trunks and branches of trees and shrubs. I have often watched winter birds at this work.

An inconspicuous insect, but one which often gives a great deal of trouble to gardeners, is Fuller's Rose Beetle (*Aramigus Fulleri*), a small beetle of the curculio family. The principal damage is done in its larval stages, when the little white grubs live in the soil and feed upon the roots of many kinds of plants. Cultivators in Boston and vicinity have frequently called my attention to this troublesome pest. Sometimes the roots have been eaten from whole beds of primroses in the open air; in winter the enemy may be damaging the roots of roses in the greenhouse. The beetle is so much like the average soil in color, that it generally escapes notice. It may often be found eating the foliage of plants in the greenhouse, and it should be destroyed whenever seen. Sometimes the damage is done by another and larger curculio (*Otiorhynchus sulcatus*) while in its stage of a small white grub. The beetles of both species are active only at night; in the daytime they are usually quiet and may be found on the ground or clinging to twigs or the under side of leaves.

Every summer, in many parts of New England, we hear complaints of the destruction of the grass of lawns by the white grubs or larvæ, of the May Beetles or June Bugs (*Lachnosterna fusca*), which live in the soil and eat the roots. Often the grass gets brown in patches, and is found to have all its roots cut away. Few of the remedies usually recommended can be called convenient or practicable.

Experiments conducted at Washington some years ago showed that white grubs of another species (*Allorhina nitida*), having a habit of feeding nearer the surface of the soil, can be destroyed by the use of kerosene emulsion, and the question naturally arises as to whether we cannot use it successfully against our local white grubs in small areas, and also against the grubs of Fuller's Rose Beetle.

Lawns or spots badly infested with white grubs may be liberally sprayed with the prepared kerosene emulsion diluted in the proportion of one gallon of the emulsion to from fifteen to twenty gallons of water. After applying the insecticide the ground should be well soaked with water several times, so that some part of the emulsion may be carried farther into the soil. The grubs will be driven from the roots of the grass and will finally die; the grass will sustain no injury from kerosene in these proportions. Where the grubs of Fuller's Rose Beetle give much trouble, I would recommend that the soil about the roots of the plants be sprayed with the kerosene emulsion, in the proportions given for the White Grub, and that the ground be well soaked with water two or three times. A stirring of the soil before the application would increase its effectiveness.

In considering means for the control of the White Grub, we ought to pay more attention to the encouragement and protection of animals which help to destroy it. The much-abused skunk is a most valuable ally in lessening the numbers of the pests. Go over a field or pasture where White Grubs are plentiful, and if skunks live in the vicinity, we are sure to find innumerable little holes made by the long claws of the skunk in digging out grubs. The flocks of crows which stalk over pastures and meadows, are often mostly employed in grub hunting. It is a difficult matter to obtain legislation for the protection of such an animal as the skunk, because of indifference, prejudice, lack of attractiveness, or from the fact that it may commit some offence. Its few evil deeds are likely to receive quicker recognition than its many good ones. In many hop growing regions the skunk now gets its full share of protection as a valuable grub hunter.

I have heard the story of a New England town, where the skunks had become so numerous that war was declared against them, a bounty being offered for each one killed, and they were almost exterminated. In the years immediately following, the grass was greatly destroyed by grubs. The people then, realizing their folly, ordered the protection of the skunk, and soon afterwards there was a marked improvement in the condition of the grass.

As a formula for making kerosene emulsion is not known by many persons, I will here present the one which has given most general satisfaction and is recommended by the Department of Agriculture.

Kerosene, two gallons; common or whale oil soap, one-half pound; water, one gallon. Dissolve the soap in the water and heat the solution, adding it, when boiling hot, to the kerosene. Churn the mixture by means of a force pump and spray nozzle for five or ten minutes. The emulsion, if perfect, forms a cream which thickens on cooling, and should adhere without oiliness to the surface of glass. Dilute before using, taking one part of the emulsion with nine parts of cold water. The three gallons of emulsion will thus give thirty gallons of insecticide, which may be sprayed upon most plants with no injury to the foliage, but will prove fatal to many kinds of insects, especially those with soft bodies, or which obtain their food by sucking. Of course if a force pump is not available the emulsion may be stirred by any convenient means. A bundle of switches will answer, if the mixture is whipped long enough.

In using Pyrethrum powder, or Buhach, care should be taken to obtain it as fresh as possible, and it should be kept in air tight vessels until it is to be used. It may be used dry, either pure or mixed with five or six parts of flour; or it may be applied in water, in the proportion of a large tablespoonful to a gallon of water and sprayed.

Hellebore is well known as fatal to the common Gooseberry and Red Currant Worms and to the larvæ of Sawflies, on roses and other plants. Besides being mixed in water in the proportion of about an ounce to two gallons, it is very often used as a pure powder, but it may be more economically applied by first mixing it with several times its own bulk of flour, in which case it will still prove very effective.

These two poisons are well adapted to common use in a small way as they are much less dangerous to man than the arsenical mixtures, the latter being also more likely to injure foliage than is the kerosene emulsion, which is a safe insecticide to handle. Of course a great many of the patented insecticides are effective and valuable. But they are usually very expensive when compared with the actual cost of the arsenical poisons, the kerosene, or other materials upon which they are largely based. Where large quantities of the poisons are to be used it is generally much more economical to prepare one's own insecticides.

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